

REMARKS

Upon entry of the amendment, claims 1-24 are pending. Claims 1 and 23 have been amended to more particularly point out the Applicant's invention.

CLAIM REJECTION – 35 U.S.C. § 102(b):

Claims 13 and 19 have been rejected under 35 U.S.C. § 102(b) as being anticipated by *Ping* U.S. Patent No. 5,616,519. In order for there to be anticipation, each and every one of the elements of the claims must be found in a single reference. It is respectfully submitted that the claims, as amended, recite elements clearly not disclosed or suggested by the *Ping* patent. For example, claim 13, as well as claim 19, which depends on claim 13, recite that the pillars are coated with a low dielectric polymer. The *Ping* patent does not disclose or suggest the use of a low dielectric polymer. Rather the *Ping* patent discloses a planarizing layer consisting of spin-on glass. As is known in the art, spin-on glass has a relatively high dielectric constant. As such, the use of such a material between metal layers would result in relatively high capacitance coupling of the device, as well as lower its propagation speed. More particularly, the propagation speed of the device is inversely proportional to the capacitance of the device. Increasing the capacitance of the device causes the propagation speed to be lowered. Using a relatively high dielectric material between metal layers forms a capacitor with a relatively high capacitance value. The invention recited in the claims at issue, on the other hand, utilizes a low capacitance value to lower the capacitive coupling and thus increase the propagation speed of the device.

The process recited in the claim at issue, also resolves the off-gassing problem mentioned in the *Ping* patent at column 1, lines 61-66, however, in a different less-complex manner. More particularly, the *Ping* patent discloses the deposition of a silicon oxide layer and chemical mechanical processing (CMP) to avoid the off-gassing problem associated with the SOG. The invention on the other hand, simply uses a low dielectric polymer coating which totally eliminates the off-gassing problem and obviates the need for additional silicon dioxide layer. Based on the above, the Examiner is respectfully requests to reconsider and withdraw the rejection of claims 13 and 19.

CLAIM REJECTION – 35 U.S.C. 103:

Claims 1, 4, 5 and 7 have been rejected as being unpatentable under 35 U.S.C. 103(a) as being unpatentable over *Lin* U.S. Patent No. 5,929,525 in view of *Kano* U.S. Patent No. 5,380,679. It is respectfully submitted that neither the *Lin* or the *Kano* patents disclose or suggest a process as recited in claims 1, 4 and 7. More particularly, claim 1 has been amended to recite the formation of one or more pillars from a photoresist which are plated to define plated pillars. The *Lin* patent, on the other hand, teaches away from a plated pillars as recited in the claims at issue and instead discloses a pillar formed solely from metal, unlike the invention recited in the claims at issue. The Examiner's attention is directed to column 4, lines 9 through 17 of the *Lin* patent. The *Kano* patent similarly fails to disclose or suggest a plated pillar as recited in the claims at issue. For all of the above reasons, the Examiner is respectfully requested to consider and withdraw the rejection of claims 1, 4, 5 and 7.

Claims 2, 6, 8 and 9 have been rejected under 35 U.S.C. 103(a) as being unpatentable over the *Lin* and *Kano* patents further in view of the Applicant's prior art. The *Lin* and *Kano* patents have been discussed above. Claims 2, 6, 8 and 9 depend on claim 1. The Applicant's admitted prior art similarly does not disclose a process which results in a plated pillar as recited in the claims at issue. For theses reason and all of the above reasons, the Examiner is respectfully requested to reconsider and withdraw the rejection of claims 2, 6, 8 and 9.

Claim 3 has been rejected under 35 U.S.C. 103(a) as being unpatentable over the *Lin* and *Kano* patents and further in view of *Sonego et al.* U.S. Patent No. 6,239,042. Claim 3 is depended upon claim 1. The *Lin* and *Kano* patents have been discussed above. The *Sonego et al.* patent was cited for teaching a layer of planarizing coating over a non-planarizing layer. However, the *Sonego et al.* patent does not otherwise disclose a plated pillar as recited in the claims at issue. For these reasons and the above reasons, the Examiner is respectfully requested to reconsider and withdraw the rejection of claim 3.

Claims 10 and 11 have been rejected under 35 U.S.C. 103(a) as being unpatentable over *Lin* and *Kano* and further in view of *Furukawa et al.* U.S. Patent No. 6,387,783. Claims 10 and 11 are depended upon claim 1. The *Lin* and *Kano* patents have been discussed above. The *Furukawa et al.* patent was cited for teaching a

photoresist with a re-entrant profile and using a negative i-line resist. The *Furukawa et al.* patent does not otherwise disclose or suggest a plated pillar as recited in the claims at issue. For these reasons and the above reasons, the Examiner is respectfully requested to reconsider and withdraw the rejection of claims 10 and 11.

Claim 12 has been rejected under 35 U.S.C. 103(a) as being unpatentable over the *Lin* patent in view of *Kano* and *Furukawa et al.* patents and further in view of *Samoto* U.S. Patent No. 5,583,063. Claim 12 is depended upon claim 1. The *Lin*, *Kano* and *Furukawa et al.* patents have been discussed above. The *Samoto* patent was cited for teaching the use of NH_3 image reversal photoresist. The *Samoto* patent does not otherwise disclose or suggest a plated pillar as recited in the claims at issue. Thus, the Examiner is respectfully requested to reconsider and withdraw the rejection of claim 12.

Claims 14 and 15 have been rejected under 35 U.S.C. 103(a) as being unpatentable over the *Ping* patent in view of the *Lin* patent. Claims 14 and 15 are depended upon claim 13. As discussed above, claims 14 and 15 recite in combination a low dielectric polymer between the metal layers in order to reduce the capacitive coupling of the device. As discussed above, the *Ping* patent teaches away from a low dielectric polymer and instead teaches the use of a spin-on glass which is known to have a relatively high dielectric constant which, in turn would increase the capacitive coupling and thus lower the propagation speed of the device. The *Lin* patent does not disclose or suggest the use of a low dielectric coating between metal layers. For these reasons and all of the above reasons, the Examiner is respectfully requested to reconsider and withdraw this rejection.

Claim 16 has been rejected under 35 U.S.C. 103(a) as being unpatentable over the *Ping* patent in view of the *Kano* and *Lin* patents.¹ Claim 16 is dependent upon claim 13. As discussed above, the *Ping* patent teaches away from the Applicant's invention. The *Lin* patent also discloses the use of a spin-on glass layer between the metal structures. The Examiner's attention is directed to column 4, lines 19-44 of the *Lin* patent. The Applicant's admitted prior art does not disclose the use of a low dielectric layer between

¹ The rejection specifically states "Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ping ('519) in view of Kano ('Lin) as applied to claims 14 and 15 above, and further in view of the applicants admitted prior art." The Applicant assumes that claim 16 is being rejected as being unpatentable over Ping, Kano, Lin and Applicant's admitted prior art.

metal layers. For these reason and all of the above reasons, the Examiner is respectfully requested to reconsider and withdraw the rejection of claim 16.

Claim 17, 20 and 21 have been rejected under 35 U.S.C. 103(a) as being unpatentable over the *Ping* patent in view of the Applicant's admitted prior art. These claims 17, 20 and 21 are depended upon claim 13. As discussed above, the *Ping* patent teaches away from the invention recited in claim 13 and thus claims, 17, 20 and 21 which depend on claim 13. As further mentioned above, the Applicant's admitted prior art further does not disclose or suggest the use of low dielectric coating as recited in these claims. For these reasons and all of the above reasons, the Examiner is respectfully requested to reconsider and withdraw the rejection.

Claim 18 has been rejected under 35 U.S.C. 103(a) as being unpatentable over the *Ping* patent in view of *Sonego et al.* patent. Claim 18 is dependent upon claim 13. As discussed above, the *Ping* patent teaches away from the invention recited in claim 18 in that the *Ping* patent teaches the use of a spin-on glass layer and not a low dielectric polymer as suggested in paragraph 13 of the detailed action. Although the *Sonego et al.* patent teaches the use of a planarizing coating over a non-planarizing layer, as mentioned above, the *Sonego et al.* does not otherwise teach or disclose the use of a low dielectric polymer between metal layers to reduce capacitive coupling of the device as the process recited in claim 18. For these reasons and the above reasons, the Examiner is respectfully request to reconsider and withdraw the rejection of claim 18.

Claims 22 and 23 have been rejected over the *Ping* patent in view of the *Furukawa et al.* patent. Claims 22 and 23 are depended upon claim 13 and thus recite in combination a low dielectric layer between metal layers. The *Furukawa et al.* patent was cited for disclosing a photoresist with a re-entrant profile and a negative i-line resist. As mentioned above, the *Furukawa et al.* patent does not otherwise disclose a process as recited in claims 22 and 23 which includes a low-dielectric material between metal layers. For these reasons and the above reasons, the Examiner is respectfully requested to reconsider and withdraw the rejection of claims 22 and 23.

Claim 24 has been rejected as being unpatentable over the *Ping* patent in view of the *Furukawa et al.* patent and further in view of the *Samoto* patent. Claim 24 is depended upon claim 13 and thus recites the process in which includes a low level of

dielectric between metal layers. As discussed above, the *Ping* patent teaches away from such a process. The *Furukawa et al.* patent was cited for teaching a negative photoresist while the *Samoto* patent was cited for teaching the use of NH_3 image reversal of a photoresist. As discussed above, neither the *Samoto* or *Furukawa et al.* patent otherwise disclose or suggest a process as recited in the claims at issue which includes the step of forming a low dielectric layer between metal layers as recited in claim 24. For these reasons and all of the above reasons, the Examiner is respectfully requested to reconsider and withdraw the rejection of claim 24.

Lack of *Prima Facie* Case of Obviousness

With respect to all of the rejections under the 35 U.S.C. 103(a), it is respectfully submitted that it is insufficient for an Examiner to merely state that the references can be modified in order to support the finding of obviousness. Rather, MPEP Section 2142 states that in order to establish a *prima facie* case of obviousness, three criteria must be met by the Examiner as follows:

“First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine the reference teachings. Second there must be a reasonable expectation of success. Finally the prior art reference (or references when combined) must teach or suggest all of the claim limitations. The teaching or suggestion to make the claim combination and the reasonable expectation of success must both be found in the prior art and not based on the Applicant’s disclosure.”


It is respectfully submitted that there has been no showing or any suggestion or motivation shown which suggests that the references be modified as suggested by the Examiner, nor has there been any showing of a reasonable expectation of success. Moreover, the *Ping* and *Lin* patents do not specifically teach the claimed limitations as amended. For these reasons, it is respectfully submitted that the Examiner has failed to make out a *prima facie* case of obviousness for any of the rejections under 35 U.S.C. 103. Accordingly, the Examiner is respectfully requested to reconsider and withdraw these rejections.

CONCLUSION

In view of the foregoing remarks, Applicant respectfully requests reconsideration of this application and that the application be passed to issues.

Respectfully submitted,

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ATTACHMENT FOR CLAIM AMENDMENTS
VERSION WITH MARKINGS TO SHOW CHANGES MADE
U.S. Serial No. 10/016,693; Filed October 30, 2001

1. (Amended) A process for forming vias in polymers with low dielectric constants, the process comprising the steps of:

- (a) providing a substrate layer;
- (b) forming a lower level layer [of] on said substrate layer, selected from one or more of the group consisting of dielectric, metal [and/or] and circuit devices [on said substrate layer];
- (c) forming a seed layer on top of said lower level layer;
- (d) forming a lower metal layer on said seed layer;
- (e) forming one or more [plated] pillars from a photoresist having top surfaces on said lower metal layer, defining photoresist pillars;
- (f) plating said photoresist pillars defining plated pillars;
- [(f)](g) removing the seed layer not under the lower level ^{metal} layer;
- [(g)](h) coating said one or more plated pillars and said seed layer with a low dielectric polymer;
- [(h)](i) curing said polymer;
- [(i)](j) exposing said top surfaces of said plated pillars; and
- [(j)](k) forming a metal layer to contact said exposed top surfaces of said plated pillars.

13. (Amended) A process for forming vias in polymers with low dielectric constants, the process comprising the steps of:

- (a) providing a substrate layer;
- (b) forming a lower level layer [of] on said substrate, selected from one or more of the group consisting of dielectric, metal [and/or] and a circuit device [on said substrate];
- (c) forming a bottom metal layer on said lower level layer;
- (d) forming one or more pillars from a photoresist on said lower metal layer;
- (e) coating said one or more pillars with a polymer coating;

- (f) curing said polymer;
- (g) etching back said polymer to expose said one or more [photoresist] pillars;
- (h) removing said one or more [photoresist] pillars to form vias; and
- (i) forming a metal layer to contact said bottom metal layer on top of said polymer coating.